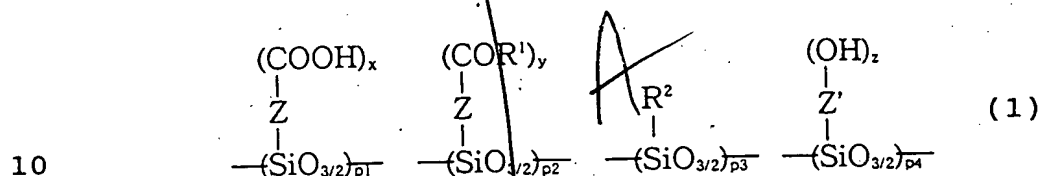


CLAIMS:

1. A high molecular weight silicone compound comprising recurring units represented by the following general formula (1), said silicone compounds having a weight average molecular weight of 1,000 to 50,000,

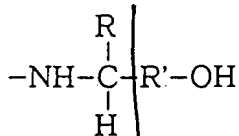


wherein Z is a divalent to hexavalent, non-aromatic, monocyclic or polycyclic hydrocarbon or bridged cyclic hydrocarbon group having 5 to 12 carbon atoms; Z' is a divalent to hexavalent, normal or branched hydrocarbon group having 1 to 20 carbon atoms or non-aromatic, monocyclic or polycyclic hydrocarbon or bridged cyclic hydrocarbon group having 3 to 20 carbon atoms, these groups may have a nitrogen, oxygen or sulfur atom interposed in a carbon-to-carbon bond, the hydrogen atom on a carbon atom may be replaced by a halogen, alkoxy, nitro, cyano or acetyl group, and a methylene group in the carbon skeleton may be replaced by a carbonyl group;

letters x, y and z are integers of 1 to 5 corresponding to the valence of Z and Z';

R¹ is a group represented by the following general formula (2a) or (2b); R² is a normal, branched or cyclic, substituted or unsubstituted, alkyl or alkenyl group having 1 to 8 carbon atoms or a monovalent, non-aromatic, polycyclic hydrocarbon or bridged cyclic hydrocarbon group having 5 to 12 carbon atoms;





(2b)

5

wherein R is hydrogen, hydroxyl group or a normal, branched or cyclic alkyl group having 1 to 20 carbon atoms, R' is a normal, branched or cyclic alkylene group having 1 to 20 carbon atoms, these alkyl and alkylene groups may have an oxygen atom interposed in a carbon-to-carbon bond, some of the hydrogen atoms attached to carbon atoms may be replaced by hydroxyl groups; or R and R', taken together, may form a ring, and each of R and R' is a normal or branched alkylene group of 1 to 8 carbon atoms when they form a ring;

10

15

letter p1 is a positive number and letters p2, p3 and p4 are 0 or positive numbers and satisfy:

$$p1+p2+p3+p4 = 1,$$

$$0 < p1/(p1+p2+p3+p4) \leq 0.9,$$

20

$$0 \leq p2/(p1+p2+p3+p4) \leq 0.8,$$

$$0 \leq p3/(p1+p2+p3+p4) \leq 0.7,$$

$$0 \leq p4/(p1+p2+p3+p4) \leq 0.9.$$

25

2. The high molecular weight silicone compound of claim 1 wherein some or all of the hydrogen atoms of carboxyl groups or carboxyl groups and hydroxyl groups in silicone compound of formula (1) are replaced by acid labile groups of at least one type, said silicone compound having a weight average molecular weight of 1,000 to 50,000.

30

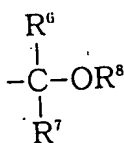
3. The high molecular weight silicone compound of claim 2 wherein the acid labile group is at least one group selected from the class consisting of groups of the following general formula (4), groups of the following general formula (5), tertiary alkyl groups of 4 to 20 carbon atoms, trialkylsilyl groups whose alkyl groups each

35

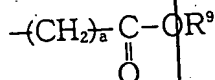
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Sub
A,

have 1 to 6 carbon atoms, and oxoalkyl groups of 4 to 20 carbon atoms,



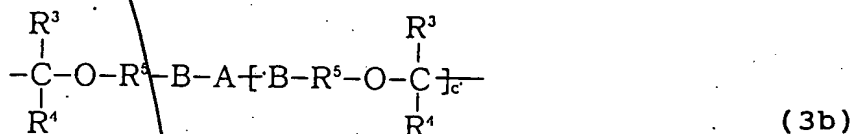
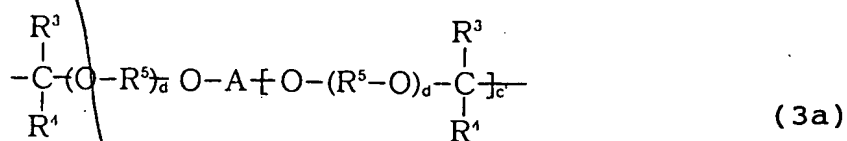
(4)



(5)

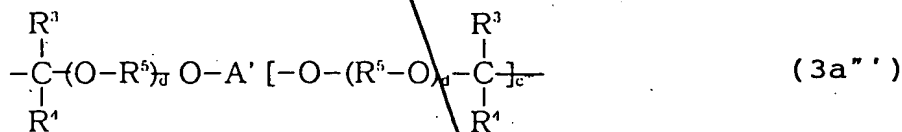
wherein R^6 and R^7 each are hydrogen or a normal, branched or cyclic alkyl group of 1 to 18 carbon atoms, R^8 is a monovalent hydrocarbon group of 1 to 18 carbon atoms which may have a hetero atom, or R^6 and R^7 , R^6 and R^8 , or R^7 and R^8 , taken together, may form a ring, and R^6 , R^7 and R^8 each are a normal or branched alkylene group of 1 to 18 carbon atoms when they form a ring, R^9 is a tertiary alkyl group of 4 to 20 carbon atoms, a trialkylsilyl group whose alkyl groups each have 1 to 6 carbon atoms, an oxoalkyl group of 4 to 20 carbon atoms or a group of the above general formula (4), and letter a is an integer of 0 to 6.

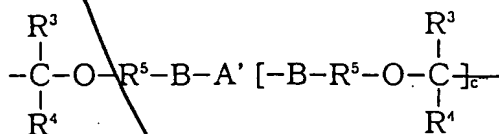
4. The high molecular weight silicone compound of claim 2 wherein some of the hydrogen atoms of carboxyl groups or carboxyl groups and hydroxyl groups in said silicone compound are replaced by acid labile groups of at least one type, and more than 0 mol% to 50 mol% of the hydrogen atoms of the carboxyl groups and/or hydroxyl groups are replaced by crosslinking groups having C-O-C linkages represented by the following general formula (3a) or (3b) whereby the silicone compound is crosslinked within a molecule and/or between molecules,



wherein each of R^3 and R^4 is hydrogen or a normal, branched or cyclic alkyl group of 1 to 8 carbon atoms, or R^3 and R^4 , taken together, may form a ring, and each of R^3 and R^4 is a normal or branched alkylene group of 1 to 8 carbon atoms when they form a ring, R^5 is a normal, branched or cyclic alkylene group of 1 to 10 carbon atoms, letter d is 0 or an integer of 1 to 10, A is a c-valent aliphatic or alicyclic saturated hydrocarbon group, aromatic hydrocarbon group or heterocyclic group of 1 to 50 carbon atoms, which may have an intervening hetero atom and in which the hydrogen atom attached to a carbon atom may be partially replaced by a hydroxyl group, carboxyl group, acyl group or fluorine atom, B is $-\text{CO}-\text{O}-$, $-\text{NHCO}-\text{O}-$ or $-\text{NHCONH}-$, letter c is an integer of 2 to 8, and c' is an integer of 1 to 7.

5. The high molecular weight silicone compound of claim 4 wherein the crosslinking group having C-O-C linkages represented by the general formula (3a) or (3b) is represented by the following general formula (3a'') or (3b''):

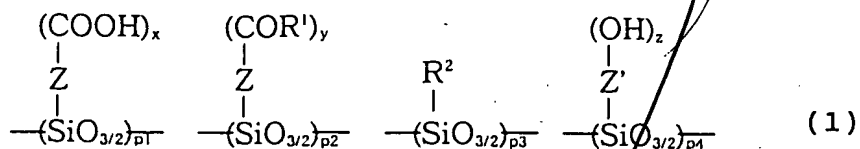




(3b'')

5 wherein each of R³ and R⁴ is hydrogen or a normal, branched or cyclic alkyl group of 1 to 8 carbon atoms, or R³ and R⁴, taken together, may form a ring, and each of R³ and R⁴ is a normal or branched alkylene group of 1 to 8 carbon atoms
10 when they form a ring, R⁵ is a normal, branched or cyclic alkylene group of 1 to 10 carbon atoms, letter d is 0 or an integer of 1 to 5, A' is a c''-valent normal, branched or cyclic alkylene, alkyltriyl or alkyltetrayl group of 1 to 20 carbon atoms or arylene group of 6 to 30 carbon
15 atoms, which may have an intervening hetero atom and in which the hydrogen atom attached to a carbon atom may be partially replaced by a hydroxyl group, carboxyl group, acyl group or fluorine atom, B is -CO-O-, -NHCO-O- or -NHCONH-, letter c'' is an integer of 2 to 4, and c''' is an
20 integer of 1 to 3.

6. A resist composition comprising
 - (A) an organic solvent,
 - (B) a base resin in the form of the high molecular
25 weight silicone compound of any one of claims 1 to 5, and
 - (C) a photoacid generator.
7. A resist composition comprising
 - (A) an organic solvent,
 - (B) a base resin in the form of a high molecular
30 weight silicone compound comprising recurring units represented by the following general formula (1), some or all of the hydrogen atoms of carboxyl groups or carboxyl groups and hydroxyl groups in said silicone compound being
35 replaced by acid labile groups of at least one type, said silicone compound having a weight average molecular weight of 1,000 to 50,000,



5 wherein Z is a divalent to hexavalent, non-aromatic, monocyclic or polycyclic hydrocarbon or bridged cyclic hydrocarbon group having 5 to 12 carbon atoms; Z' is a
10 divalent to hexavalent, normal or branched hydrocarbon group having 1 to 20 carbon atoms or non-aromatic, monocyclic or polycyclic hydrocarbon or bridged cyclic hydrocarbon group having 3 to 20 carbon atoms, these groups may have a nitrogen, oxygen or sulfur atom
15 interposed in a carbon-to-carbon bond, the hydrogen atom on a carbon atom may be replaced by a halogen, alkoxy, nitro, cyano or acetyl group, and a methylene group in the carbon skeleton may be replaced by a carbonyl group;

letters x, y and z are integers of 1 to 5 corresponding to the valence of Z and Z';

20 R¹ is a group represented by the following general formula (2a) or (2b); R² is a normal, branched or cyclic, substituted or unsubstituted, alkyl or alkenyl group having 1 to 8 carbon atoms or a monovalent, non-aromatic, polycyclic hydrocarbon or bridged cyclic hydrocarbon group
25 having 5 to 12 carbon atoms;



30



35 wherein R is hydrogen, hydroxyl group or a normal, branched or cyclic alkyl group having 1 to 20 carbon atoms, R' is a normal, branched or cyclic alkylene group

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having 1 to 20 carbon atoms, these alkyl and alkylene groups may have an oxygen atom interposed in a carbon-to-carbon bond, some of the hydrogen atoms attached to carbon atoms may be replaced by hydroxyl groups; or R and R', taken together, may form a ring, and each of R and R' is a normal or branched alkylene group of 1 to 8 carbon atoms when they form a ring;

letters p1, p2, p3 and p4 are 0 or positive numbers and satisfy:

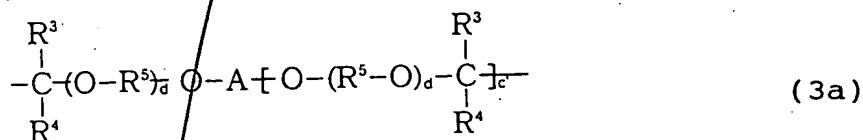
$$\begin{aligned} 10 \quad & p1+p2+p3+p4 = 1, \\ & 0 < p1/(p1+p2+p3+p4) \leq 0.9, \\ & 0 \leq p2/(p1+p2+p3+p4) \leq 0.8, \\ & 0 \leq p3/(p1+p2+p3+p4) \leq 0.7, \\ & 0 \leq p4/(p1+p2+p3+p4) \leq 0.9, \end{aligned}$$

15 with the proviso that p1 and p4 are not equal to 0 at the same time, and that p3 is not equal to 0 and at least some of R² groups are monovalent, non-aromatic, polycyclic hydrocarbon or bridged cyclic hydrocarbon groups when p1 is 0, and

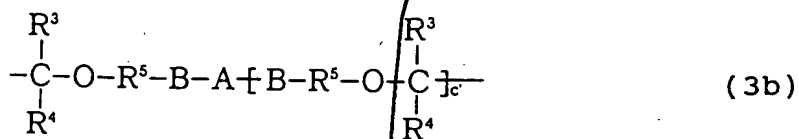
20 (C) a photoacid generator.

8. The resist composition of claim 7 wherein some of the hydrogen atoms of carboxyl groups or carboxyl groups and hydroxyl groups in said silicone compound are replaced by acid labile groups of at least one type, and

25 more than 0 mol% to 50 mol% of the hydrogen atoms of the remaining carboxyl groups and/or hydroxyl groups are replaced by crosslinking groups having C-O-C linkages represented by the following general formula (3a) or (3b) whereby the silicone compound is crosslinked within a molecule and/or between molecules,



35



5 wherein each of R³ and R⁴ is hydrogen or a normal, branched or cyclic alkyl group of 1 to 8 carbon atoms, or R³ and R⁴, taken together, may form a ring, and each of R³ and R⁴ is a normal or branched alkylene group of 1 to 8 carbon atoms
10 when they form a ring, R⁵ is a normal, branched or cyclic alkylene group of 1 to 10 carbon atoms, letter d is 0 or an integer of 1 to 10, A is a c-valent aliphatic or alicyclic saturated hydrocarbon group, aromatic hydrocarbon group or heterocyclic group of 1 to 50 carbon
15 atoms, which may have an intervening hetero atom and in which the hydrogen atom attached to a carbon atom may be partially replaced by a hydroxyl group, carboxyl group, acyl group or fluorine atom, B is -CO-O-, -NHCO-O- or -NHCONH-, letter c is an integer of 2 to 8, and c' is an
20 integer of 1 to 7.

9. The resist composition of claim 7 further comprising (D) a dissolution inhibitor.

25 10. The resist composition of claim 7 further comprising (E) a basic compound.

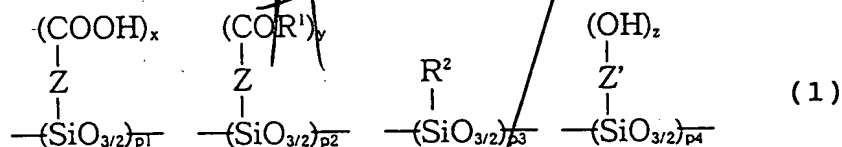
11. The resist composition of claim 7 further comprising (F) a compound having a group represented by =C-COOH in a
30 molecule.

12. The resist composition of claim 7 further comprising (G) an acetylene alcohol derivative.

35 13. A resist composition comprising (A) an organic solvent,

(B) a base resin in the form of a high molecular weight silicone compound comprising recurring units represented by the following general formula (1), or a high molecular weight silicone compound in which some of the hydrogen atoms of carboxyl groups or carboxyl groups and hydroxyl groups in the silicone compound of formula (1) are replaced by acid labile groups of at least one type, said silicone compound having a weight average molecular weight of 1,000 to 50,000.

10



15 wherein Z is a divalent to hexavalent, non-aromatic, monocyclic or polycyclic hydrocarbon or bridged cyclic hydrocarbon group having 5 to 12 carbon atoms; Z' is a divalent to hexavalent, normal or branched hydrocarbon group having 1 to 20 carbon atoms or non-aromatic, monocyclic or polycyclic hydrocarbon or bridged cyclic hydrocarbon group having 3 to 20 carbon atoms, these groups may have a nitrogen, oxygen or sulfur atom interposed in a carbon-to-carbon bond, the hydrogen atom on a carbon atom may be replaced by a halogen, alkoxy, nitro, cyano or acetyl group, and a methylene group in the carbon skeleton may be replaced by a carbonyl group;

25 letters x, y and z are integers of 1 to 5 corresponding to the valence of Z and Z';

30 R¹ is a group represented by the following general formula (2a) or (2b); R² is a normal, branched or cyclic, substituted or unsubstituted, alkyl or alkenyl group having 1 to 8 carbon atoms or a monovalent, non-aromatic, polycyclic hydrocarbon or bridged cyclic hydrocarbon group having 5 to 12 carbon atoms;

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5



wherein R is hydrogen, hydroxyl group or a normal,
 10 branched or cyclic alkyl group having 1 to 20 carbon
 atoms, R' is a normal, branched or cyclic alkylene group
 having 1 to 20 carbon atoms, these alkyl and alkylene
 groups may have an oxygen atom interposed in a carbon-to-
 carbon bond, some of the hydrogen atoms attached to carbon
 15 atoms may be replaced by hydroxyl groups; or R and R',
 taken together, may form a ring, and each of R and R' is a
 normal or branched alkylene group of 1 to 8 carbon atoms
 when they form a ring;

letters p₁, p₂, p₃ and p₄ are 0 or positive numbers
 20 and satisfy:

$$p_1 + p_2 + p_3 + p_4 = 1,$$

$$0 < p_1 / (p_1 + p_2 + p_3 + p_4) \leq 0.9,$$

$$0 \leq p_2 / (p_1 + p_2 + p_3 + p_4) \leq 0.8,$$

$$0 \leq p_3 / (p_1 + p_2 + p_3 + p_4) \leq 0.7,$$

25 $0 \leq p_4 / (p_1 + p_2 + p_3 + p_4) \leq 0.9,$

with the proviso that p₁ and p₄ are not equal to 0 at the
 same time, and that p₃ is not equal to 0 and at least some
 of R² groups are monovalent, non-aromatic, polycyclic
 hydrocarbon or bridged cyclic hydrocarbon groups when p₁
 30 is 0,

(C) a photoacid generator, and

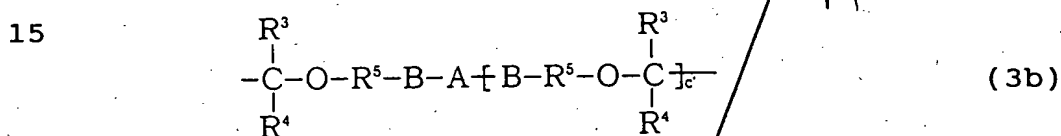
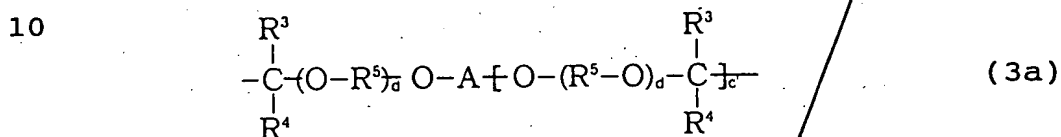
(H) a crosslinkable compound by the action of acid.

14. The resist composition of claim 13 wherein some of
 35 the hydrogen atoms of carboxyl groups or carboxyl groups

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and hydroxyl groups in said silicone compound are replaced by acid labile groups of at least one type, and

more than 0 mol% to 50 mol% of the hydrogen atoms of the remaining carboxyl groups and/or hydroxyl groups are replaced by crosslinking groups having C-O-C linkages represented by the following general formula (3a) or (3b) whereby the silicone compound is crosslinked within a molecule and/or between molecules,



wherein each of R³ and R⁴ is hydrogen or a normal, branched or cyclic alkyl group of 1 to 8 carbon atoms, or R³ and R⁴, taken together, may form a ring, and each of R³ and R⁴ is a normal or branched alkylene group of 1 to 8 carbon atoms when they form a ring, R⁵ is a normal, branched or cyclic alkylene group of 1 to 10 carbon atoms, letter d is 0 or an integer of 1 to 10, A is a c-valent aliphatic or alicyclic saturated hydrocarbon group, aromatic hydrocarbon group or heterocyclic group of 1 to 50 carbon atoms, which may have an intervening hetero atom and in which the hydrogen atom attached to a carbon atom may be partially replaced by a hydroxyl group, carboxyl group, acyl group or fluorine atom; B is -CO-O-, -NHCO-O- or -NHCONH-, letter c is an integer of 2 to 8, and c' is an integer of 1 to 7.

35 15. A method for forming a pattern comprising the steps of:

(i) applying a chemically amplified positive resist composition according to claim 7 or 13 onto a substrate,

(ii) heat treating the coated film and then exposing it to actinic radiation having a wavelength of up to 300 nm or electron beams through a photo mask, and

(iii) optionally heat treating the exposed film and developing it with a developer.

Add
#2

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